CLAIMS

1. A method for determining an output color value for a destination pixel located between first and second adjacent source pixels having respective color values, the method comprising:

calculating a first color slope between the color value of a previous pixel and the color value of the first pixel;

calculating a second color slope between the color value of a subsequent pixel and the color value of the second pixel;

approximating first and second color gradients cosited with the first and second pixels, the approximation based on a multiple of the first and second color slopes, all respectively;

solving coefficients for a cubic polynomial transition model between the first and second adjacent pixels from the color values of the first and second pixels and the approximations of the first and second color gradients; and

determining an output color value from the cubic model to render a resampled destination image.

2. The method of claim 1 wherein approximating the first and second color gradients comprises multiplying the first and second color slopes by two.

3. The method of claim 2 wherein multiplying the first and second color slopes by two comprises shifting a binary value representing the color slopes right one bit.

4. The method of claim 1, further comprising:

determining whether the first and second slopes have opposite polarities; and

where the polarities are opposite, approximating the first and second color gradients as being equal to the first and second color slopes, respectively,

otherwise approximating the first and second color gradients as being equal to twice the first and second color slopes, respectively.

5. The method of claim 1, further comprising:

calculating a third color slope between the color values of the first and second pixel; and

approximating the first color gradient as twice the lesser of the first and third slopes and the second color gradient as twice the lesser of the second and third slopes.

6. The method of claim 5, further comprising:

determining whether the first and third slopes have opposite polarities;

determining whether the second and third slopes have opposite polarities; and

approximating the first color gradient as being equal to the first slope where the polarities of the third slope and the first slope are opposite, and approximating the second color gradient as being equal to the second slope where the polarities of the third slope and the second slope are opposite.

7. The method of claim 1 wherein calculating first and second color slopes, approximating and solving are repeated along two orthogonal axes to determine the output color value.

8. The method of claim 1 wherein solving coefficients of the transition model comprises solving:

$k = f_1 - f_0,$

$C_3 = gr_1 + gr_0 - 2k,$

$C_2 = k - C_3 - gr_0,$

$C_1 = gr_0$, and

$C_0 = f_0,$

where f_0 represents the first color value, f_1 represents the second color value, gr_0 represents the first color gradient, and gr_1 represents the second color gradient.

9. A method for determining an output sample value for a destination pixel located between first and second adjacent source pixels having respective sample values, the method comprising:

calculating a first sample slope between the sample values of a previous pixel and the first pixel;

calculating a second sample slope between the sample values of a subsequent pixel and the second pixel;

calculating a third sample slope between the sample values of the first and second pixels;

approximating first and second sample gradients cosited with the first and second pixels, the approximation of the first sample gradient based on a multiple of the first or third sample slopes and the approximation of the second sample gradient based on a multiple of the second or third sample slopes;

solving coefficients for a cubic polynomial transition model between the first and second adjacent pixels from the sample values of the first and second pixels and the approximations of the first and second sample gradients; and

determining an output sample value from the cubic model to render a resampled destination image.

10. The method of claim 9 wherein red, blue and green color components are each processed separately as a frame of samples.

11. The method of claim 9 wherein calculating first, second, and third sample slopes, approximating and solving are repeated along two orthogonal axes to determine the output sample value.

12. The method of claim 9 wherein approximating the first sample gradient comprises multiplying the lesser of the first and third sample slopes by two and approximating the second sample gradient comprises multiplying the lesser of the second and third sample slopes by two.

13. The method of claim 12, further comprising:

determining whether the first and third slopes have opposite polarities;

determining whether the second and third slopes have opposite polarities; and

approximating the first sample gradient as being equal to the first slope where the polarities of the third slope and the first slope are opposite, and approximating the second sample gradient as being equal to the second slope where the polarities of the third slope and the second slope are opposite.

14. The method of claim 12 wherein multiplying the lesser of the first and third sample slopes by two and multiplying the lesser of the second and third sample slopes by two comprise shifting a binary value representing the sample slopes up by one bit position.

15. The method of claim 9 wherein solving coefficients of the transition model comprises solving:

$k = f_1 - f_0,$

$C_3 = gr_1 + gr_0 - 2k,$

$C_2 = k - C_3 - gr_0,$

$C_1 = gr_0$, and

$C_0 = f_0,$

where f_0 represents the first color value, f_1 represents the second color value, gr_0 represents the first sample gradient, and gr_1 represents the second sample gradient.

16. A resampling circuit adapted to receive signals representing respective sample values for a previous sample, first and second adjacent samples, and a subsequent sample, the resampling circuit calculating a first sample slope from the sample values of the previous and first pixels, calculating a second sample slope from the sample value of the subsequent and second sample, approximating first and second sample gradients at the first and second samples based on a multiple of the first and second sample slopes, all respectively, solving coefficients for a cubic polynomial transition model between the first and second adjacent samples from the sample values of the first and second samples and the

approximations of the first and second sample gradients, and determining an output sample value from the cubic model to render a resampled destination image.

17. The resampling circuit claim 16 wherein approximating the first and second sample gradients comprises multiplying the first and second sample slopes by two.

18. The resampling circuit of claim 17, further adapted to shift a binary value representing the sample slopes up one bit to multiply the sample slopes by two.

19. The resampling circuit of claim 16 wherein the color values comprise red, blue and green color components.

20. The resampling circuit of claim 16, further adapted to calculate first and second sample slopes, approximate first and second sample gradients, and solve coefficients of the transition model along two orthogonal axes to determine the output sample value.

21. The resampling circuit of claim 16, further adapted to determine whether the first and second slopes have opposite polarities, and where the polarities are opposite, approximate the first and second color gradients as being equal to the first and second color slopes, respectively, otherwise approximate the first and second color gradients as being equal to twice the first and second color slopes, respectively.

22. The resampling circuit of claim 16, further adapted to calculate a third sample slope from the sample values of the first and second sample, and approximate the first sample gradient as twice the lesser of the first and third slopes and the second sample gradient as twice the lesser of the second and third slopes.

23. The resampling circuit of claim 22, further adapted to determine whether the first and third slopes have opposite polarities and whether the second and third

slopes have opposite polarities, and approximate the first sample gradient as being equal to the first slope where the polarities of the third slope and the first slope are opposite, and approximate the second sample gradient as being equal to the second slope where the polarities of the third slope and the second slope are opposite.

24. A resampling circuit for determining an output sample value for a destination sample located between first and second adjacent source samples having respective sample values, the circuit comprising:

a means for calculating a first sample slope between the sample values of a previous sample and the first sample;

a means for calculating a second sample slope between the sample values of a subsequent sample and the second sample;

a means for calculating a third sample slope between the sample values of the first and second samples;

a means for approximating first and second sample gradients at the first and second sample positions, the approximation of the first sample gradient based on a multiple of the first or third sample slopes and the approximation of the second sample gradient based on a multiple of the second or third sample slopes;

a means for solving coefficients for a cubic polynomial transition model between the first and second adjacent samples from the sample values of the first and second samples and the approximations of the first and second sample gradients; and

a means for determining an output sample value from the cubic model to render a resampled destination image.

25. The circuit of claim 24 wherein the red, blue and green color components are each processed separately as a frame of samples.

26. The circuit of claim 24 wherein the means for approximating the first and second sample gradients comprises a multiplying means for multiplying the lesser of the

first and third sample slopes by two and multiplying the lesser of the second and third sample slopes by two.

27. The circuit of claim 26, further comprising:

determining means to determine whether the first and third slopes have opposite polarities and whether the second and third slopes have opposite polarities; and

wherein the means for approximating calculates the first sample gradient as being equal to the first slope where the polarities of the third slope and the first slope are opposite, and calculates the second sample gradient as being equal to the second slope where the polarities of the third slope and the second slope are opposite.

28. The circuit of claim 26 wherein the multiplying means comprises a bit shifting circuit for shifting a binary value representing the color slopes up one bit position.

29. A graphics processing system, comprising:

a bus interface for coupling to a system bus;

a graphics processor coupled to the bus interface to process graphics data;

address and data busses coupled to the graphics processor to transfer address and graphics data to and from the graphics processor;

display logic coupled to the data bus to drive a display; and

a resampling circuit coupled to the graphics processor and the display logic and adapted to receive signals representing respective sample values for a previous sample, first and second adjacent samples, and a subsequent sample, the resampling circuit calculating a first sample slope from the sample values of the previous and first samples, calculating a second sample slope from the sample value of the subsequent and second samples, approximating first and second sample gradients at the first and second samples based on a multiple of the first and second sample slopes, all respectively, solving coefficients for a cubic polynomial transition model between the first and second adjacent samples from the sample values of the first and second samples and the approximations of the first and second

sample gradients, and determining an output sample value from the cubic model to render a resampled destination image.

30. The graphics processing system of claim 29 wherein the resampling circuit approximates the first and second sample gradients comprises by multiplying the first and second sample slopes by two.

31. The graphics processing system of claim 30 wherein the resampling circuit is further adapted to determine whether the first and second slopes have opposite polarities, and where the polarities are opposite, approximate the first and second sample gradients as being equal to the first and second sample slopes, respectively, otherwise approximate the first and second sample gradients as being equal to twice the first and second sample slopes, respectively.

32. The graphics processing system of claim 29 where the resampling circuit is further adapted to calculate a third sample slope from the sample values of the first and second pixel, and approximate the first sample gradient as twice the lesser of the first and third slopes and the second sample gradient as twice the lesser of the second and third slopes.

33. The graphics processing system of claim of claim 32 wherein the resampling circuit is further adapted to determine whether the first and third slopes have opposite polarities and whether the second and third slopes have opposite polarities, and approximate the first sample gradient as being equal to the first slope where the polarities of the third slope and the first slope are opposite, and approximate the second sample gradient as being equal to the second slope where the polarities of the third slope and the second slope are opposite.

34. A computer system, comprising:

a system processor;

a system bus coupled to the system processor;

a system memory coupled to the system bus; and

a graphics processing system coupled to the system bus, the graphics processing system, comprising:

a bus interface for coupling to the system bus;

a graphics processor coupled to the bus interface to process graphics data;

address and data busses coupled to the graphics processor to transfer address and graphics data to and from the graphics processor;

display logic coupled to the data bus to drive a display; and

a resampling circuit coupled to the graphics processor and the display logic and adapted to receive signals representing respective sample values for a previous sample, first and second adjacent samples, and a subsequent sample, the resampling circuit calculating a first sample slope from the sample values of the previous and first samples, calculating a second sample slope from the sample value of the subsequent and second pixels, approximating first and second sample gradients at the first and second pixels based on a multiple of the first and second sample slopes, all respectively, solving coefficients for a cubic polynomial transition model between the first and second adjacent samples from the sample values of the first and second samples and the approximations of the first and second sample gradients, and determining an output sample value from the cubic model to render a resampled destination image.

35. The computer system of claim 34 wherein the resampling circuit of the graphics processing system approximates the first and second sample gradients comprises by multiplying the first and second sample slopes by two.

36. The computer system of claim 34 wherein the resampling circuit of the graphics processing system is further adapted to determine whether the first and second slopes have opposite polarities, and where the polarities are opposite, approximate the first and second sample gradients as being equal to the first and second sample slopes,

respectively, otherwise approximate the first and second color gradients as being equal to twice the first and second sample slopes, respectively.

37. The computer system of claim 34 where the resampling circuit of the graphics processing system is further adapted to calculate a third sample slope from the sample values of the first and second samples, and approximate the first sample gradient as twice the lesser of the first and third slopes and the second sample gradient as twice the lesser of the second and third slopes.

38. The computer system of claim of claim 37 wherein the resampling circuit of the graphics processing system is further adapted to determine whether the first and third slopes have opposite polarities and whether the second and third slopes have opposite polarities, and approximate the first sample gradient as being equal to the first slope where the polarities of the third slope and the first slope are opposite, and approximate the second sample gradient as being equal to the second slope where the polarities of the third slope and the second slope are opposite.